Samarium/cobalt separation by solvent extraction with ionic liquids

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End-of-life SmCo magnets are valuable secondary source of rare-earth elements and cobalt [1]. In this work, the solvent extraction of metals from SmCo magnets by ionic liquids was investigated. Undiluted ionic liquids represent a greener and safer alternative in solvent extraction to common volatile and flammable molecular solvents, like kerosene or toluene [2]. Three different solvent extraction systems are compared in order to upscale the most convenient one to a continuous process (mixer-settler with a countercurrent circuit). The three studied extraction systems were the commercial ionic liquid Aliquat® 336 with chloride counter ions combined with a chloride aqueous phase, and as an example of a split-anion extraction, Aliquat® 336 with a thiocyanate or a nitrate anion in combination with a chloride aqueous phase [3]. The systems were compared in terms of metal distribution ratios, extraction efficiencies, volume changes, metal loadings, scrubbing, stripping and reusability of the ionic liquid. The phase disengagement time was studied as a function of different parameters, relevant to the design of the mixer-settler.

References:

[1] European Training Network for the Design and Recycling of Rare-Earth Permanent Magnet Motors and Generators in Hybrid and Full Electric Vehicles (DEMETER). Website: http://etn-demeter.eu/project/

[2] T. Vander Hoogerstraete, S. Wellens, K. Verachtert, K. Binnemans, "Removal of transition metals from rare earths by solvent extraction with an undiluted phosphonium ionic liquid: separations relevant to rare-earth magnet recycling", Green Chemistry **15**, 919-927 (2013).

[3] K. Larsson, K. Binnemans, "Separation of rare earths by split-anion extraction", Hydrometallurgy **156**, 206–214 (2015).